Undergraduate Research in the Faculty of Informatics of Madrid

Maria Covadonga Fernandez-Baizan
Rafael Portaencasa Baeza
Rosa Gonzalez Tirados
Polytechnical University of Madrid

1. INTRODUCTION

To receive the degree in Computer Engineering, students of the Faculty of Informatics of the Polytechnical University of Madrid, must carry out a Project under the supervision of a professor.

Such a Project, may consist of the resolution of a problem coming from the "real world", by using the adequate technics learned by the student, or, on the contrary, may be in fact the first research work carried out by the student, as a training for the further realization of a Ph. D. Thesis.

In this paper, we describe several works of this kind, carried out under our supervision, pertaining to the field of Data and Knowledge Engineering.

2. THE DATA BASE RESEARCH GROUP OF THE FACULTY OF INFORMATICS OF THE POLYTECHNICAL UNIVERSITY OF MADRID

The Faculty of Informatics of the Polytechnical University of Madrid is divided into several Departments: "Mathematics", "Computers, Architecture and Technology", "Artificial Intelligence" and "Languages, Systems and Software Engineering".

The Data Base Group pertains to the last Department above mentioned. Our current research topics are:

- Advanced topics of the Relational Model
- Object-Oriented Databases
- Deductive Databases

We are at present collaborating with other groups from Spain and other European countries (France, United Kingdom, Netherlands, Italy and Greece) in the FAD (Formal Aspects of Databases) Project, supported by the HCM (Human Capital and Mobility) Program of the European Community.

In recent years, several students have received the degree in Computer Engineering after having developed a research work under our supervision.

In the following, we briefly describe some of these works.

References at the end of this paper, are the reports corresponding to the research works, that have been published by our Publications Department and that may be found in our Library.

3. RESEARCH WORKS ON ADVANCED TOPICS OF THE RELATIONAL MODEL

- "Application of the Topology to the Relational Model" (3)

  In this work, the connection between Topology and Relational Model is stated.
  Namely, it is demonstrated that functional dependencies can be seen as Moore-Smith networks. Coming from this result, a new ("topological") Algorithm to determine keys is proposed.

- "Algorithm of Analysis and Synthesis of Third Normal Form Schemas" (2)

  In this work it is developed a method of analysis of the level of normalization of a given Relational Schema. If this level is not "3" (Codd's Third Normal Form), a procedure to Synthesize Third Normal Form Schemas from it (while preserving the equivalence) is given.

- "A Module to Synthesize Third Normal Form Schemes" (10)

  Not very different from the above mentioned work, this one is based in an Algorithm proposed in 1976 by P. Bernstein and C. Beeri.

- "Obtention of the Keys of a Relational Schema" (11)

  In this work it is proposed a new (original) method, called simplification-reduction, to reduce the complexity of the problem of finding the keys of a Relational Schema. This method allows us (in many cases) to reduce the size of the

original set of functional dependencies (in the worse case, any simplification may be obtained).

- "A Turbo-Prolog Relational DBMS; Querying Module" (12)

  This work is a part of a Project consisting of the development of a Relational Data Base Management System based on the specifications given by D. Yi in his book "A PROLOG DATABASE SYSTEM".

- "Implementing on ADABAS the integrity rules of the Relational Model" (8)

  The ADABAS DBMS does not support the integrity rules of the Relational Model.
  This work consists of the implementation of these rules on the ADABAS DBMS.

- "Implementation of the Kernel of a Relational DBMS" (7)

  This work is a part of Project consisting of the development of a Relational Data Base Management System that uses the Universal Relations as user interface and incorporates an original method to optimize queries.

4. RESEARCH WORKS ON DEDUCTIVE DATABASES

- "Logic Queries in Deductive Databases" (9)
- "Deductive Databases: Concepts, Design, Optimization" (4)
- "Deductive Databases: DATALOG Model (5)

  The three works above mentioned have to do with the problem of querying Deductive Databases by using Logic as Language of Queries.

- "Automatic Adquisition of Knowledge from Examples: ITRULE Algorithm" (1)

  This work pertains to the field of automatic learning and also to the field of Knowledge Bases. It provides an Algorithm to infer rules from facts contained in a Data Base.

- "Inferring quantitative rules in Relational Data Bases" (6)

  This work pertains also to the field of automatic learning and knowledge Bases.

  Here, an alternative method to derive rules from facts, that is based on the generalization principle, is exposed.

5. REFERENCES

1. "ADQUISICION AUTOMATICA DE CONOCIMIENTO A PARTIR DE EJEMPLOS: ALGORITMO ITRULE"
   A. L. Blanco Rubio
   Facultad de Informática de la UPM (SPAIN) - 1991

2. "ALGORITMO DE ANALISIS Y DISEÑO DE ESQUEMAS EN TERCERA FORMA NORMAL DE CODD"
   B. Sanz del Molino
   Facultad de Informática de la UPM (SPAIN) - 1984

3. "APLICACION DE LA TOPOLOGIA AL MODELO RELACIONAL"
   L. E. Múnera
   Facultad de Informática de la UPM (SPAIN) - 1986

4. "BASES DE DATOS DEDUCTIVAS: CONCEPTO DISEÑO Y OPTIMIZACION"
   L. M. González Casillas
   Facultad de Informática de la UPM (SPAIN) - 1991

5. "BASES DE DATOS DEDUCTIVAS: MODELO DATALOG"
   V. Alonso Secades
   Facultad de Informática de la UPM (SPAIN) - 1992

6. "DESCUBRIMIENTO DE REGLAS CUANTITATIVAS EN BASES DE DATOS RELACIONALES"
   C. Sánchez Sánchez
   Facultad de Informática de la UPM (SPAIN) - 1992

7. "ESTUDIO, ANALISIS Y DISEÑO DE UN SGBDR E IMPLEMENTACION DEL NUCLEO"
   E. Santos Menéndez
   Facultad de Informática de la UPM (SPAIN) - 1992

8. "IMPLEMENTACION EN ADABAS DE LAS REGLAS DE IDENTIDAD DEL MODELO RELACIONAL"

   Facultad de Informática de la UPM (SPAIN) - 1992

9. "MODELIZACION DE CONSULTAS LOGICAS EN BASES DE DATOS DEDUCTIVAS"
   B. Chao Novo
   Facultad de Informática de la UPM (SPAIN) - 1991

10. "MODULO DE AYUDA AL DISEÑO DE BASES DE DATOS RELACIONALES"
    A. M. Pérez Llano
    Facultad de Informática de la UPM (SPAIN) - 1989

11. "OBTENCION DE LAS CLAVES DE UN ESQUEMA RELACIONAL"
    N. Segura Chinchilla
    Facultad de Informática de la UPM (SPAIN) - 1989

12. "UN SGBDR EN TURBO-PROLOG: MODULO DE CONSULTAS A LA BASE"
L.M. Carro Martínez
Facultad de Informática de la UPM
(SPAIN) - 1989

María Covadonga Fernández-Baizán

She was born in Oviedo (Spain) in 1956 and has received the degrees of Electronic Engineering (1978) and Ph. D. in Computer Science (1981), both in the Polytechnical Univeristy of Madrid.

Since 1981 she is working in the field of Data Bases. She has published many papers and several books on this topic.

She is, at present, full professor at the Faculty of Informatics of the UPM, where she is head of the Department of Languages, Systems and Software Engineering.

Since 1983 she has visited, as invited professor, different Universities from several South-american and European countries.

Rafael Portaencasa Baeza

He was born in Madrid (Spain) in 1936 and has received the degrees of Electronic Engineering (1961), Computer Scientist (1966) and Ph. D. in Electronic Engineering; all in the Polytechnical University of Madrid.

His scientific work in the field of Computer Science is well known in many American and European countries.

He is, at present, Rector of the Polytechnical University of Madrid.

Rosa González Tirados

She was born in Leon (Spain), and received a Ph. D. in Psychology.

As Director of the ICE (Education Science Institute) of the Polytechnical University of Madrid, she is responsible for the introduction and application of new methods and technologies in the educational process; and for evaluating its results.

She has published many papers and several books in the field of Education in Engineering, and has collaborated in many educational projects with South-american countries.